Importance of the Atmosphere

Dana Desonie, Ph.D.

AUTHOR
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CHAPTER 1

Importance of the Atmosphere

- Describe Earth's atmosphere and explain the important roles it plays in sustaining life on Earth.

If Earth didn't have an atmosphere, would it always be cold?

This is a question commonly asked by 12-year-old girls being driven to school by their mothers. "Of course," the moms answer, "it would be extremely hot when the Sun is out and bitter cold when it's dark." Does this conversation sound familiar?

What Is the Atmosphere?

Earth's **atmosphere** is a thin blanket of gases and tiny particles — together called air. We are most aware of air when it moves and creates wind. Earth's atmosphere, along with the abundant liquid water at Earth's surface, are the keys to our planet's unique place in the solar system. Much of what makes Earth exceptional depends on the atmosphere. For example, all living things need some of the gases in air for life support. Without an atmosphere, Earth would likely be just another lifeless rock.

Let's consider some of the reasons we are lucky to have an atmosphere.

Gases Indispensable for Life on Earth

Without the atmosphere, Earth would look a lot more like the Moon. Atmospheric gases, especially carbon dioxide (CO_2) and oxygen (O_2), are extremely important for living organisms. How does the atmosphere make life possible? How does life alter the atmosphere?

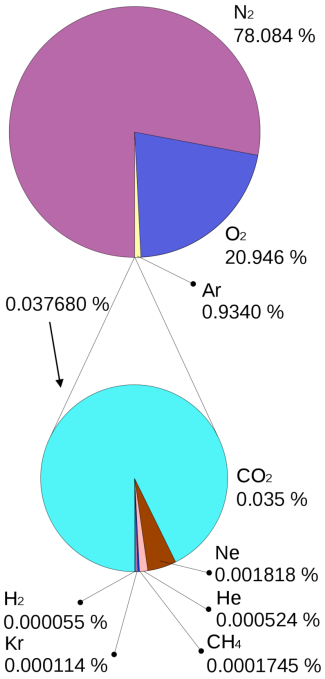


FIGURE 1.1

The composition of Earth's atmosphere.

Photosynthesis

In **photosynthesis**, plants use CO_2 and create O_2. Photosynthesis is responsible for nearly all of the oxygen currently found in the atmosphere.

The chemical reaction for photosynthesis is:

$6CO_2 + 6H_2O + \text{solar energy} \rightarrow C_6H_{12}O_6 \text{ (sugar)} + 6O_2$

Respiration

By creating oxygen and food, plants have made an environment that is favorable for animals. In **respiration**, animals use oxygen to convert sugar into food energy they can use. Plants also go through respiration and consume some of the sugars they produce.

The chemical reaction for respiration is:

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{useable energy}$

How is respiration similar to and different from photosynthesis? They are approximately the reverse of each other. In photosynthesis, CO_2 is converted to O_2 and in respiration, O_2 is converted to CO_2 (**Figure** 1.2).

Crucial Part of the Water Cycle

As part of the hydrologic cycle, water spends a lot of time in the atmosphere, mostly as water vapor. The atmosphere is an important reservoir for water.

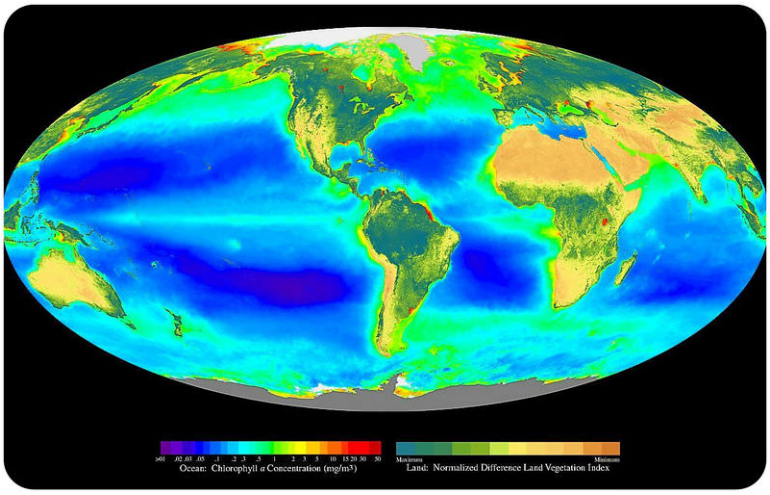


FIGURE 1.2

Chlorophyll indicates the presence of photosynthesizing plants as does the vegetation index.

Ozone Makes Life on Earth Possible

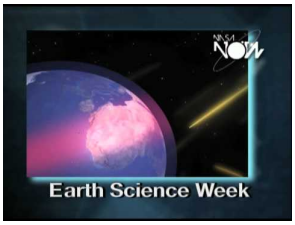
Ozone is a molecule composed of three oxygen atoms, (O_3). Ozone in the upper atmosphere absorbs high-energy **ultraviolet (UV) radiation** coming from the Sun. This protects living things on Earth's surface from the Sun's most harmful rays. Without ozone for protection, only the simplest life forms would be able to live on Earth. The highest concentration of ozone is in the ozone layer in the lower stratosphere.

Keeps Earth's Temperature Moderate

Along with the oceans, the atmosphere keeps Earth's temperatures within an acceptable range. Without an atmosphere, Earth's temperatures would be frigid at night and scorching during the day. If the 12-year-old in the scenario above asked why, she would find out. **Greenhouse gases** trap heat in the atmosphere. Important greenhouse gases include carbon dioxide, methane, water vapor, and ozone.

Provides the Substance for Waves to Travel Through

The atmosphere is made of gases that take up space and transmit energy. Sound waves are among the types of energy that travel though the atmosphere. Without an atmosphere, we could not hear a single sound. Earth would be as silent as outer space (explosions in movies about space should be silent). Of course, no insect, bird, or airplane would be able to fly, because there would be no atmosphere to hold it up.



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Summary

- The atmosphere is made of gases that are essential for photosynthesis and respiration, among other life activities.
- The atmosphere is a crucial part of the water cycle. It is an important reservoir for water and the source of precipitation.
- The atmosphere moderates Earth's temperature because greenhouse gases absorb heat.

Review

1. What gases are used and expelled by photosynthesis and respiration?
2. Where is the largest concentration of ozone and what value does it have?
3. How does the atmosphere keep Earth's temperature moderate?

Explore More

Use these resources to answer the questions that follow.

MEDIA

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1. What is the composition of the atmosphere?
2. What does the atmosphere do?
3. How are humans clanging the composition of the atmosphere?
4. What is the negative effect of that?
5. If Earth didn't have an atmosphere what would global temperatures be like?
6. Why don't you feel the air pressure of the air above you?

References

1. User:Mysid/Wikipedia. Composition of the atmosphere . Public Domain
2. Provided by the SeaWiFS Project, NASA/Goddard Space Flight Center and ORBIMAGE. Satellite image of t he plant coverage of the world . Public Domain